



# Thorax Computed Tomography Findings in Non-Traumatic Cases Hospitalized in the Intensive Care Unit

## Yoğun Bakım Ünitesinde Yatan Nontravmatik Hastalarda Toraks Bilgisayarlı Tomografi Bulguları

Intensive Care Unit and Thorax Imaging

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### Özet

**Amaç:** Yoğun bakım ünitesinde yatan ve solunum sıkıntısı olan nontravmatik hastalarda bilgisayarlı tomografi ile toraksta izlenen patolojik bulguların değerlendirilmesi amaçlanmıştır. **Gereç ve Yöntem:** Hastanemizde 2015-2016 yılları arasında yoğun bakım ünitesinde tedavi gören 43 hasta çalışmaya kabul edildi. Radyoloji arşivinden elde edilen toraks bilgisayarlı tomografi görüntüleri iki radyoloji uzmanı tarafından değerlendirildi. Hastaların klinik bulguları ve laboratuvar sonuçları hasta dosyalarından dökümente edildi. **Bulgular:** Hastaların cinsiyet dağılımı 9 kadın (% 20.9) ve 34 erkek (% 79.1) şeklindedi ve ortalama yaş  $71.1 \pm 15.4$  (21-89) yıl olarak bulundu. En sık tespit edilen bulgular, mediastende vasküler ateroskleroz, lenfadenomegali ve perikardiyal efüzyon iken akciğer parankiminde ise fibrozis, akciğer nodülü ve amfizematöz havalanma artışı idi. Plevral efüzyon sıklığı % 53.5 olarak saptandı. **Tartışma:** Yoğun bakım ünitesine yatan hastalarda alta yatan özellikle nörolojik ve kardiyovasküler hastalıkların olması ve genel durum bozukluğu solunum sistemi patolojileri için risk oluşturmaktadır.

### Anahtar Kelimeler

Yoğun Bakım Ünitesi; Solunum Sıkıntısı; Bilgisayarlı Tomografi

### Abstract

**Aim:** To assess thoracic CT findings in non-traumatic patients with respiratory distress hospitalized in the intensive care unit. **Material and Method:** Forty-three patients treated in the intensive care unit in our hospital in 2015-2016 were included in the study. Thorax CT images obtained from the radiology archive were assessed by two radiology specialists. Patients' clinical findings and laboratory results were documented from the patients' records. **Results:** Nine patients (20.9%) were female and 34 (79.1%) were male. Mean age was  $71.1 \pm 15.4$  (21-89) years. The most common findings in the mediastinum were vascular atherosclerosis, lymphadenomegaly, and pericardial effusion, while the most common parenchymal findings were parenchymal fibrotic changes, pulmonary nodule, and emphysematous aeration. The prevalence of pleural effusion was 53.5%. **Discussion:** The presence of underlying neurological and cardiovascular diseases in particular and general condition impairment in patients hospitalized in the intensive care unit represents a risk for the development of respiratory system pathologies.

### Keywords

Intensive Care Unit; Respiratory Distress; Computed Tomography

DOI: 10.4328/JCAM.4335

Received: 23.01.2016 Accepted: 10.02.2016 Printed: 01.09.2016

J Clin Anal Med 2016;7(5): 618-20

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## Introduction

Intensive care units are departments for critical patients with impaired vital functions who require continuous monitoring. It is important for personnel in these units to be specially trained, and a rapid and correct approach to changes occurring in the patients' clinical pictures is required [1].

In addition to their primary pathologies, patients hospitalized in the intensive care unit frequently encounter respiratory tract problems including aspiration (associated with their being unconscious and receiving ventilator support), pneumonia, pulmonary edema, and atelectasis [2]. Unconsciousness and multi-organ failure in these patients mean that the data obtained from physical examination are limited, and imaging is important in diagnosis and monitoring [3].

Portable chest radiography is the main imaging technique used because it can be performed at the bedside and is simple to administer. Digital radiography has become more widely used because of the increase in image quality and lower dose adjustment, but it still has various disadvantages [4]. The main disadvantages are the limited ability to assess mediastinal structures, lack of patient cooperation, inadequacy of single-plane images, and the fact that the pleural effusion and pulmonary edema frequently seen in these patients restrict evaluation of the parenchyma [2,5]. With advantages such as high resolution, multiplanar imaging, absence of superposition, and the ability to assess mediastinal structures, computed tomography (CT) counters the defects of pulmonary radiography. The ability to differentiate consolidation, mass, and atelectasis with the administration of contrast material and to show pulmonary embolism increases the importance of tomography in thoracic evaluation in intensive care patients [6]. In this study, we assessed imaging findings of patients hospitalized in the intensive care unit for reasons other than trauma, who were undergoing CT due to respiratory difficulty.

## Material and Method

Forty-three patients hospitalized in the intensive care unit for reasons other than trauma at the Canakkale Onsekiz Mart University Hospital in 2015-2016 and undergoing CT due to respiratory distress were included in the study. Age, sex, history of chronic disease, and laboratory findings were documented from patients' records. Patients admitted to intensive care due to trauma or aged under 18 were excluded. Thorax CT imaging obtained in a routine protocol from the radiology archive in our hospital was evaluated. (Toshiba, Asteion TSX-021B, 4 detector tomography device, 120 kV, 150 mAs, 5 mm section thickness). All cases were assessed by two specialist radiologists. Statistical analysis was performed using SPSS 19.0 for Windows software. Student's t test was used to analyze qualitative data and the chi square test was used for quantitative data.

## Results

Nine (20.9%) of the 43 patients in the study were female and 34 (79.1%) were male. Mean age was  $71.1 \pm 15.4$  (21-89) years. The most common primary health problems prior to hospitalization in the intensive care unit were cardiovascular diseases, stroke, and chronic obstructive pulmonary disease (COPD). Primary diseases before admission to primary care are given in

Table 1.

Table 1. Patients' pre-hospitalization primary diseases

Primary Disease	Case number	Percentage (%)
Cardiovascular disease	12	27.9
Cerebrovascular disease	8	18.6
COPD	7	16.3
Renal failure	5	11.6
Infection	4	9.3
Alzheimer	2	4.7
Other	5	11.6

Upon evaluation of mediastinal structures, atherosclerosis was determined in 30 (69.8%) patients, lymphadenomegaly in 9 (20.1%), pericardial effusion in 8 (18.6%), and pulmonary artery dilatation in 4 (9.3%) patients. Accompanying pleural effusion was determined in seven of the eight patients with pericardial effusion. Intense bilateral pleural calcification associated with exposure to asbestos was determined in two of the 15 cases (34.9%) with thickening in the pleura or extrapleural fat tissue and mesothelioma in one case (Figure 1). Pleural effusion was determined in 23 patients (53.5%), bilateral in form in 14.

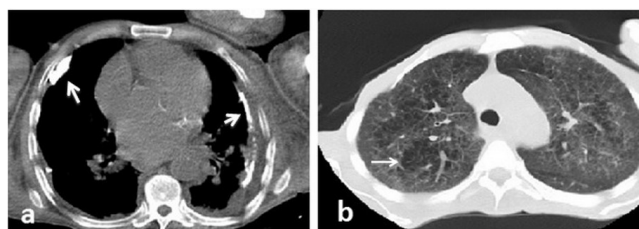


Figure 1. Axial CT images show pleural thickening/calcification (a) and emphysematous aeration (b).

The most common findings upon evaluation of pulmonary parenchyma were atelectasis, parenchymal fibrosis, and pulmonary nodule (46.5%, 39.5%, and 37.2%, respectively). Thickening in the interstitium was determined in 7 cases (16.3%) and bronchiectasis in 6 patients (14%). The findings most commonly accompanied by emphysematous aeration were parenchymal nodule and fibrotic parenchymal changes (68.75% and 62.5%, respectively, Figure 2). Metastatic nodules were determined in

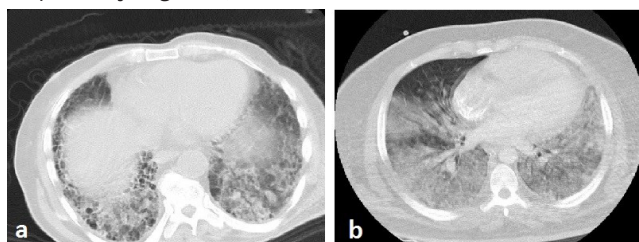


Figure 2. Axial CT images show thickening in the interstitium (a) and bilateral diffuse ground-glass densities (b).

three cases and dilation in the pulmonary arteries in four patients. Distribution of lesions in the parenchyma and mediastinum is shown in Table 2.

## Discussion

Intensive care units are departments for critical patients with impaired vital functions and frequently multi-organ injury or failure. The primary pathology in these patients may be accom-

Table 2. Distribution of commonly seen parenchymal and mediastinal findings

Radiological finding	Case (n)	Percentage (%)
Atherosclerosis	30	69.8
Pleural effusion	23	53.5
Atelectasis	20	46.5
Parenchymal fibrosis	17	39.5
Emphysematous aeration	16	37.2
Pulmonary nodule	16	37.2
Consolidation	15	34.9
Lymphadenomegaly	9	20.1
Pericardial effusion	8	18.6
Interstitial thickening	7	16.3
Bronchiectasis	6	14

panied by respiratory system problems such as pulmonary edema and thromboembolic disease and particularly pneumonia [7]. Since these patients' general condition is poor, bronchoscopy and portable radiography are used to attempt to identify respiratory system problems at the bedside. If diagnosis cannot be established, other imaging techniques, and particularly CT, are used [8].

We used CT in this study. The most common radiological finding was atherosclerotic changes in the aorta and coronary vascular structures. This was largely due to the advanced age of our study population, and the association between atherosclerosis and primary pathologies such as ischemic heart disease, COPD, and cerebrovascular disease [9]. Another common finding, observed in 53.5% of our patients, was pleural effusion. Atelectasis, paralytic drug use, fluid loading for hemodynamic support, and pneumonia developing in patients due to mechanic ventilators are predisposing factors for pleural effusion [10]. Mattison et al. reported a prevalence of pleural effusion of 62%, and determined that heart failure, atelectasis, and infections are the most common causes [11]. The prevalence of pleural effusion in our study was 53.5%, and the level of atelectasis in these patients reached 63.4%.

Atelectasis, which develops in association with obstruction caused by secretions, is common in intensive care patients, particularly in the obese, smokers, and elderly patients. It is the main cause of opacity seen at pulmonary radiography in these patients [6, 12]. It generally takes the form of subsegmental atelectasis and is localized in the lower left lobe (66%), lower right lobe (22%), and right upper lobe (11%) [13]. The incidence of atelectasis in this study was 51.2%, and of subsegmental atelectasis 34.9%. All cases of compression atelectasis developed secondary to pleural effusion.

The most common causes of hospital-acquired pneumonias are gram (-) bacilli or gram (+) cocci. Radiologically, they appear as interstitial, alveolar, or mixed pattern infiltrations. A peripheral alveolar lobar pattern frequently indicates *Streptococcus pneumoniae* or *Klebsiella pneumoniae* infections [14,15]. The pneumonic consolidation rate in this study was 34.9% (n=15). This high rate was effected by pneumonia being the primary disease in five cases, and by aspiration occurring in two cases. Other common findings included emphysematous changes, pulmonary nodule, and parenchymal fibrotic changes. All three conditions were mainly observed in patients with a history of COPD and cardiovascular disease. Acute respiratory distress syndrome is

a potentially fatal condition following severe diseases such as sepsis, shock, trauma, aspiration, or intoxication. Radiological findings are nonspecific and may be confused with pulmonary edema and hemorrhage, in particular [16]. In the early period, non-dependent regions appear normal or close to normal, while ground-glass opacities and consolidation are seen in dependent regions. In the late period, subpleural bullae and cysts may develop [8,16]. In our study group, ARDS developed in two patients under monitoring due to sepsis and heart failure; CT findings in both cases were characterized by diffuse ground-glass densities.

In conclusion, respiratory system problems are commonly encountered in association with primary diseases or by an impaired general condition in patients hospitalized in intensive care units. CT is the main imaging technique in differential diagnosis and treatment planning when radiography is inadequate.

### Competing interests

The authors declare that they have no competing interests.

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### How to cite this article:

Resorlu M, Aylanc N, Adam G, Eker N. Thorax Computed Tomography Findings in Non-Traumatic Cases Hospitalized in the Intensive Care Unit. *J Clin Anal Med* 2016;7(5): 618-20.